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# SELECTIONS AND NEWS BRIEFS FROM HUA-HSUEH KUNG-YEH (CHEMICAL INDUSTRY)

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- COMMUNIST CHINA -



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# SELECTIONS AND NEWS BRIEFS FROM HUA-HSUEH KUNG-YEH (CHEMICAL INDUSTRY)

[The following are translations of selected articles and news briefs from Hua-hsueh Kung-yeh, No. 10, Peiping, 21 May 1960.]

## CONTENTS

# DOMESTIC SULFURIC ACID-MAKING TOWERS CONVERTED TO SMALL-SCALE CONTACT PROCESS WITHOUT ACID SPRAYING

[Following is the translation of an article written by Li Shang-p'eng and Ch'en Hsien-yang, Hunan Leng-shui-tan Chemical Works in Hua-hsueh Kung-yeh (Chemical Industry), Peiping, No. 10, 21 May 1960, pp. 36-37.]

Two sets of domestic sulfuric acid-making towers in our factory (80 tons per year) have been converted to small-scale contact process installations. Acid spraying is not conducted in the second unit. Beginning in the middle of November 1959 up to the present, the average daily production has been 900 to 1100 kilograms. Acid strength has reached 98% and fuming acid makes up one-third of the total production. For each ton of acid, 1.36 tons of iron pyrite is consumed.

The labor force has consisted of 36 persons of three shifts daily, who are engaged in the original domestic tower process (extraction of acid by labor) which has been reduced to ten (including breaking up of iron pyrite ore). The cost of the acid has been reduced 63% compared with that produced by the original process.

## Rebuilding of Flow Installations

In the course of rebuilding the original installations, the following changes have been made:

1. Lump burners remain unchanged except that a vertical converter has been added to its top. This addition keeps the gas which enters the converter at a constant temperature. The $SO_3$ outlet in the center of the converter cover has been connected with cooling tubes. The joint between these two, 0.5 cm. in the vicinity thereof, is secured with glass threads and tightly sealed with a pasty mixture of lime and sand. Whenever the contact mass is clogged, it can be brought out and sieved by removing the cover of the converter. The loss in each sieving amounts to about 20 g. The catalytic mass, after sieving, quickly resumes its function without reheating.

2. The first tower of the original system developed cracks after one year and was in danger of collapsing. Consequently, one of its sections was torn down and is now used as No. 1 cooling tower. Its inner walls are lined with anti-acid clay. A large pig-iron cooking pot filled with cold water has been fitted on top of this tower. During the course of production, the hot $SO_3$ gas in the converter, after it is cooled off

by the cold water, quickly combines with the water in the system and condenses into acid. This arrangement also avoids cracking the masonry caused by heating.

3. The original second, third, and fourth towers are used as air-cooled cooling towers after the removal of the Rashig rings. Such an arrangement has saved two-thirds of iron tubes for the cooling of $SO_3$ gas. Due to a large cooling area and the slow gas flow rate, better cooling has resulted. The temperature of cooled gas is 120 to 180° Centigrade.

4. By using the original fifth and sixth towers for absorption towers, we allow $SO_3$ to be fully condensed and acid production is increased.

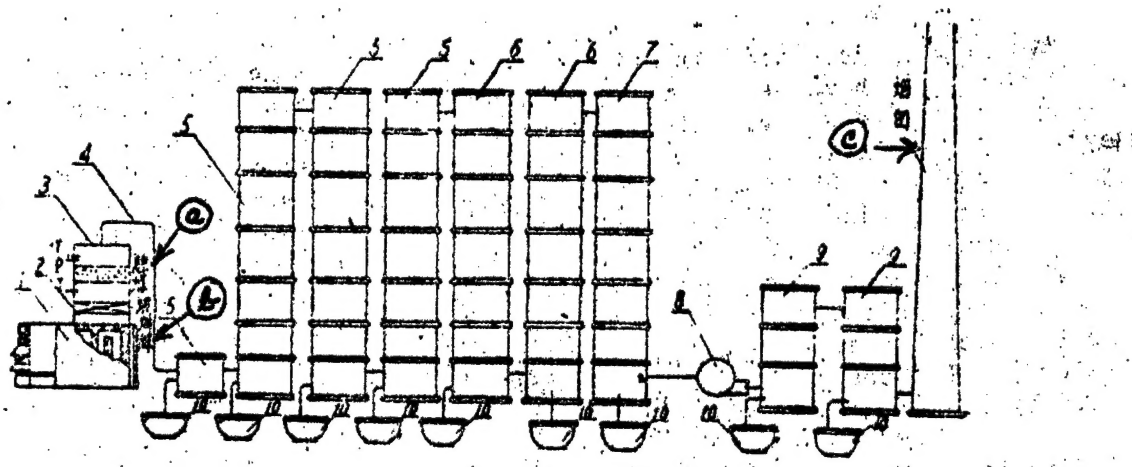

Diagram of Flow Installation after Improvement
a. Catalytic mass; b. Glass wool; c. Chimney

5. The seventh tower is used as a defoaming tower and is situated in front of the blower. If the charcoal is of good quality and has a high absorbing power, then most of the acid fumes are eliminated, thus prolonging the blower's life.

6. Two charcoal defoaming towers have been added behind the blower to collect large amounts of acid fumes and free acid to increase the yield.

A flow diagram after the rebuilding of the installation is attached. 1. Lump burner -- four burners with a burning area of 0.57 $m^2$. each. Total burning area -- 2.28 $m.^2$; 2. Dust elimination compartment -- barrier walls are used to eliminate dust. Three barrier walls are built with red bricks; 3. Converter -- a round cylinder made of 3 mm. thick steel sheets, which has a diameter of 1.2 m., height of 1 m., and is filled with 0.12 $m.^3$ catalytic mass

with a thickness of 100 mm. A layer of glass wool is placed underneath the catalytic mass for further dust elimination purposes. (Two kerosene drums were used as converters earlier due to the shortage of steel sheets.) 4. $SO_3$ cooling tubes -- 3.5 m. in overall length. They are made by joining tubes with a diameter of 250 mm. The enameled cast iron joints are filled with red paper board, glass wool, and anti-acid clay. 5. Cooling towers -- total of four. Each has a diameter of 50 cm., height of 3.5 m., except the first one. All of them are hollow. 6. Absorption towers -- height of 3.5 m. Two towers joined in series. The base consists of anti-acid clay tiles with a layer of anti-acid bricks underneath. Three layers of 50 x 50 mm. Rashig rings are packed above the base. More Rashig rings, 25 x 25 mm., about 3 m. in height, form the topmost layer. 7. Defoaming tower -- diameter of 50 cm. Bricks are lined around the base. It is filled with 20 layers of Rashig rings, 25 x 25 mm. Beneath the rings there are three layers of charcoal of 50, 25, and 15 mm. in coarseness. Each of the three layers is about 20 cm. thick. (Total: 60 cm.). 8. Blower -- homemade with steel sheet. Air pressure: 300 mm. water column. Capacity: 500 $m.^3$ per hour. Wattage: 2.8 kw. RPM 2900. 9. Number two and three defoaming towers -- these are new additions. Each has a diameter of 50 cm. The base is lined with bricks all around and on top there are 12 layers of Rashig rings, 25 x 25 mm. The charcoal layers are laid as in the above defoaming tower. 10. Storage tank.

Production Conditions

Acid pump is not used in the rebuilt small-scale contact process and acid spraying is not employed. The concentration of burner gas is 5-9%. The converter gas inlet temperature is 420-450°C., outlet temperature, 480-520°C.; air pressure at inlet and outlet of converter is 10-12 mm. water column. The cooling tower gas inlet temperature is 320-380°C. Gas inlet temperature in the absorption tower is about 180°C., outlet, 100-110°C. The air pressure at the top of the cooling tower is 26-32 mm. water column. Our highest one-day production was 100 kg. in December 1959. The average daily production is kept at about one ton. The acid output at the No. 1 cooling tower is 25%. The other towers totalled 5% and the defoaming tower lined behind the blower accounts for 70%.

Acid spraying is not employed in the whole system. Water comes invariably from the following three sources: (1) From the ore which usually contains about 5% water; (2) From air; and (3) From spraying with weak acid in the absorption tower when fuming acid becomes too strong.

Operational Notes

Following our experiences the following two points should be noted in order that normal operation may be assumed and production increased.

1. Raising burning intensity in the lump burner -- this can be achieved by frequent poking, avoiding tight packing and caking, and keeping the burning even. These are the most important steps to be taken care of.

Furthermore, ores are added alternately to the four burners at a fixed schedule and with fixed amounts. Grate shaking and constant poking are also maintained.

In the process of poking, the poker is never withdrawn from the burning layer in order to keep normal burning. Lumps formed are removed. However, if the burning layer sinks, then the lumps are broken up instead of being removed to assure a high burning temperature. To attain high production, the fireman should be diligent and careful in keeping the burning at a brisk pace.

2. Good air passage and an airtight system should be maintained. Leakage is more liable to occur when air passage in the system is poor. We have enlarged the converter and increased the cooling area for $SO_3$ gas. Since acid spraying is not adopted, the $SO_3$ combines with the water in the system and on cooling becomes acid. In order to keep free air passage, the glass wool in the converter is replaced at each shift.

At present our system is still not leakproof and blocking occurs easily in the contact mass. These are the problems yet to be studied and solved.

# METHODS FOR INCREASING CURRENT EFFICIENCY IN THE PRODUCTION OF SODIUM HYDROXIDE BY ELECTROLYSIS

[Following is the translation of an article written by Shanghai T'ien-yuan Chemical Works in Hua-hsueh Kung-yeh, Peiping, No. 10, 21 May 1960, page 38.]

Editor's Note: In the electrolytic production of sodium hydroxide by Shanghai T'ien-yuan Chemical Works, the current efficiency is comparatively high. It is usually kept above 95.5%. The increase in current efficiency has great significance in increasing production and saving materials. Therefore, it is worthwhile for other producers of sodium hydroxide by electrolysis to study these experiences.

In the course of our sodium hydroxide production, the current efficiency has been gradually increased from 91-92% in January to higher than 95.5% in February. Although current cell density has successively been raised, yet under the precise control of workers in cell management and processing, and also by the fact that key problems were solved incessantly by the Party-led three-unified group, this result has thus been attained.

In order to increase current efficiency the following technological details were taken care of:

1. Raising of the brine quality. The sodium chloride content in brine was raised from 305-310 g. per liter to above 315 g. per liter. The following measures were taken in the process: (a) water condensed from steam was used to dissolve the salt; steam was employed for heating in effecting the solution and the temperature was kept above 40°C. throughout this process; (b) keeping a constant level of salt layer in the dissolving tank; scheduled removal of mud from the dissolving tank; (c) intensified the analysis for $Ca^{++}$, $Mg^{++}$ contents which were kept below 10 mg. per liter. A pre-heater was built with used materials to heat the brine to 40°C. Sedimentation agents were continuously added to the settling tanks. Through this process, the $Ca^{++}$, $Mg^{++}$ content in brine was reduced to eight-nine mg. per liter; (d) salt containing many impurities had to be washed to remove part of the $Ca^{++}$, $Mg^{++}$ before being used to prepare the brine.

2. Strengthening cell control and management. To strengthen correct management and control of T'ien-yuan type, 16 cell workers were organized to determine the cell current efficiency and anodic gaseous $CO_2$ content, relationship between caustic soda concentration and pH value of anodic liquor. The results showed that if the gaseous $CO_2$ content at anode is greater than 2% or the pH value of anodic liquor is greater than

four, then the current efficiency cannot be kept above 95%; when the caustic soda concentration in the electrolytic liquor is 110-135 g. per liter, current efficiency is 96-97%; if the concentration of caustic soda exceeds 135 g. per liter, then the current efficiency drops rapidly.

3. Adjusting the anodic liquor level and stabilizing the caustic soda concentration. Each shift was assigned to analyze the overall electrolytic liquor four times and to maintain the average caustic soda concentration at 120-130 g. per liter. Each cell was analyzed once every two days. Cells met the specified concentration, i.e. 110-135 g. per liter totalling 80%. Concentration in new cells was about 90 g. per liter. The anodic liquor level was adjusted on the basis of specified caustic soda concentration and the process was guided by the liquor level record. Those that reached a concentration of above 150 g. per liter and could not be adjusted to a higher concentration were classified under the dismantling and rebuilding plan.

We have raised the current density appropriately to about ten in order to increase production. Although the cell load has increased, yet on stabilizing the caustic soda concentration by proper adjustment of the cell liquor level, current efficiency is not lowered.

We have intensified liaison between different departments. For instance, if the power supply of the pre-heat temperature of brine fluctuates, then the liquor level can be adjusted immediately.

Working details on the diaphragm have also been improved. The replacing liquor was added from all sides. The asbestos fiber paste should be evenly mixed and the concentration of caustic soda should not be too diluted when operation has just commenced.

4. Prevention of current leakage. The following measures were adopted to prevent current leakage: (a) workers were assigned to each area for the specific job of keeping up the cells; (b) installation of the current disconnector for electrolytic liquor should be balanced so that each drop is collected in the funnel; (c) Examination of conditions of current break-off on inflow of brine; (d) the fillers for the seams of the cells were two asphalt-treated asbestos cords partitioned by asphalt clay; (e) the asphalt sealer used in the cells were all replaced by high-melting asphalt, thus avoiding blisters and reducing short circuits in the cells; (f) Installation of a pilot light for the ground voltage and voltmeter. The total voltage in normal operations is about 580 volts; the ground voltage of the two ends is about 290 volts, which amounts to a small difference. However, if the indicator shows a great difference, then a serious current leakage exists at one end and correction should be made immediately. (g) Rebuilding of old cells into late models.

The result of the current efficiency increase during the past year was achieved with the support and guidance of the Party. We shall continue our efforts striving for greater achievements.

## NEWS BRIEFS

/Following are various items which appeared under the title, "News Briefs," compiled by the editor in Hua-hsueh Kung-yeh, Peiping, No. 10, 21 May 1960, pages 25 and 39./

### Progressive Organization of Communes to Build Up Chemical Industries Extensively Undertaken by Sinkiang Chemical Industries Bureau

To support agricultural output, the Sinkiang Chemical Industries Bureau has organized various people's communes in building chemical industries. Plans have been drafted by the Bureau to develop chemical industries sponsored by the communes. Each commune is to build one diversified chemical factory within the year.

The guiding principles of such commune-built factories are: based on self-sufficient spirit, to process locally whatever resources are available locally for local consumption; following a firm, steady policy; combining foreign and domestic processes with emphasis on the latter; and developing small native workshop groups.

In order to carry out this plan successfully, personnel from the design and research departments, etc., of the Bureau have been dispatched to start development work in the south and north of T'ien Shan. Exploratory groups have also been sent to assist various districts in examining possibilities of establishing small-scale mines for chemicals to be used by commune-sponsored chemical factories.

### Yen-shih Hsien, Li Village People's Commune, Extensively Built Chemical Fertilizer Plants

Beginning in February of this year, the Yen-shih Hsien, Li Village People's Commune in Honan Province, carried out experiments in the fixation of atmospheric nitrogen (by cyanamide process) and collected ammonia gas from smoke. These experiments were successful after extensive testing for one month. A visit consisting of more than 1,200 persons was immediately organized by the commune's Party Committee, and over 2,100 persons were recruited from various battalions to form 28 specialized groups. These groups soon led the whole commune with great enthusiasm in collecting ammonia gas from smoke channels. One after the other, each battalion, production group, middle and grade school, factory and mine enterprise have built workshops for collecting atmospheric nitrogen. A total of 89

chemical fertilizer plants and 398 furnaces were built from 15 April to 25 April, with a result that each battalion has its plant.

The 628 chimneys in the 294 mess halls in the whole commune have all been utilized to collect ammonia wherever available. Up to the moment, 95,200 chin [chin - 0.5 kg.] of liquid ammonia, 8,500 chin of solid nitrogen fertilizer have been produced by the whole commune. This fertilizer has been applied to 2,812 mou [one mou - 6,000 ft.$^2$] of No. 3 seedlings, which soon changed their pace of growth so that they are now comparable to No. 1 and No. 2 seedlings.

Production of Calcium, Magnesium, Phosphorus Fertilizers at the I Shan Chemical Fertilizer Factory Quadrupled

Production of calcium, magnesium, and phosphorus fertilizer by domestic small-scale tall furnaces at the Liu Chou I Shan Chemical Fertilizer Factory has quadrupled by using anthracite instead of coke, raising air pressure, and improving existing techniques.

Extensive Development of New Products Undertaken by Chemical Industries Enterprises in Wu Han Municipality Resulting in Increases in Product Variety and Production Respectively

Under the guidance of the Party, the workers of chemical industries in Wu Han Municipality adopted the communistic bold spirit, "transforming ideas into deeds" and also diligently following the sure and steady pace policy which results in speedy increases in production. Through the technical revolution campaign centered on mechenization and automation, in the beginning of the first quarter of 1960, increases in production have reached six times and in product variety, seven times. Or, one quarter is equivalent to one and a half years in terms of production. The production rate as compared to the same period of last year has been raised to 222%.

Big Gains in Mechanization Made by Chemical Industries Enterprises in Chia Hsing Special District, Chekiang

Due to the intensity of the technological revolution carried out by the chemical industries in the Chia Hsing District, mechanization or semi-mechanization in the whole area has been raised to 70%, thus saving labor greatly. Personnel transferred from various chemical industries totalled 417.

For example, the expanded Lin An Chemical Fertilizer Factory, instead of recruiting 500 workers as originally planned, has transferred 107 workers to aid recently built industries. 159 varieties of new products were successfully tested and manufactured, e. g. extracting yellow phosphorus from bone meal, extracting oil from pine roots, etc.

The total value of chemicals produced by the whole district for the first quarter of this year showed an increase of 51.7% over the fourth

quarter of last year. This record has thus broken the tradition of the first quarter production being usually lower than the fourth quarter.

Semi-Automatic Gas Analysis Materialized at Branch of Southwest Chemical Industries Design Institute

In order to increase the working efficiency and reduce labor, the branch of Southwest Chemical Industries Design Institute, by adopting experiences of other units, has designed a set of semi-automatic transferring installations for gas analysis. After many alterations this set of installations has now assumed normal working procedures. By using this set of installations, four sets of gas analysis apparatus can be controlled by one person, and after further practice, the number of apparatuses eventually can be increased to seven, thus increasing working efficiency four to six times.

Production Competition Within the Trade Began at Seven Major Sulfuric Acid Manufacturing Plants in Liaoning Province

To fulfill and exceed the national plan for sulfuric acid production this year, seven major sulfuric acid manufacturing plants in Liaoning Province have begun an intensified, within the trade, friendly competition. Participants are the Dairen Chemical Factory, Chin [Chou] West 401, Fu Shun Petroleum No. 1, No. 2, An [Shan] Steel and Chemical Factory, Pen [Chi Hu] No. 1 Steel Works, and Pen [Chi Hu] No. 2 Coking Plant.

The national plan for sulfuric acid production in Liaoning Province this year calls for an increase of 24.5% over last year. However, after consultation among the above-named seven plants, it is found that this plan can be exceeded with extra effort. The estimated figure comes to 37.5% higher than that of last year, and the exceeded portion is equivalent to the overall national sulfuric acid production in 1950.

In this competition each of the seven units is not only one of the participants, but is also a leader. That is to say, the chairmanship will be rotated among the participants. The chairman will be responsible for organizing inspections, comparisons, and exchange of experiences, etc. All the participants should accept the leadership of the chairman and are required to submit scheduled reports and summaries, and to attend meetings.

The "Four, Eight Crisscross Processing Method" Advocated by the Hsiang-shan Iron Pyrite Mine Obtains Outstanding Results

At the new peak of the mass technological reforms and revolution, and to meet the demand of the high-speed development of iron pyrite mining, the Hsiang-shan Pyrite Mines extensively pushed the "Four, Eight Crisscross Processing Method" and obtained outstanding results. Daily production figures for the first half of April exceeded those for March over three

times and more than six times over the average daily production of last year. These figures exceeded the designed production level by 32.58%. Other production aims such as working effieiency and daily area production capacity also showed substantial increases over those of last year. Consumption of shoring timbers has been considerably reduced.

New Flow Plan in Ammonium Sulfate Manufacture Tested by Kuanghsi Chemical Research Institute A Success

Tests of a new flow plan in ammonium sulfate manufacture undertaken by Kuanghsi Chemical Research Institute have been successful. The new plan cut investment costs and steel building materials considerably. Moreover, production cost will also be appreciably lowered. The Ministry of Chemical Industries in its circulars requested all organizations concerned to pay attention to these experiences which should be adopted extensively and tested either in production or new plant designs.

Overcoming Literature Method Limitations in Turquoise Blue Production by Not Using Ice

Workers at the Tientsin No. 4 Dyestuffs and Chemical Factory have overcome the limitations of literature method in turquoise blue production in finding a new process without using ice. This new process saves 5,000 tons of ice in producing every 100 tons of product. At the same time, it eliminates heavy menial labor in breaking and transporting ice, etc. Moreover, it has shortened the production cycle.

Method for Rapid Heat-up of Boiler Found by Shanghai Hsin-yeh Acid Factory

Recently, under the call for "time saving, fight for sulfuric acid," the Shanghai Hsin-yeh Acid Factory has found a method for the rapid heat-up of boilers, thus cutting the time required for raising the temperature from four hours to 20 minutes. This method has saved not only large quantities of wood and diesel fuel, but production reaches normal level as soon as it has commenced.

New Blasting Record Established by Hsin-an Hsien Iron Pyrite Mines

The seventh sub-division of the first workshop of the Hsin-an Hsien Iron Pyrite Mines in Honan Province has intensified technological revolutions. Based on the original rate of 20,000 chin at one blasting, a new record of 250,000 chin has been established, increasing working efficiency 12.5 times.

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